Risk and protective factors for falls from furniture in young children: multicentre case-control study

Denise Kendrick, DM[1]; Asiya Maula, MPH[2]; Richard Reading, MD[3]; Paul Hindmarch, MA[4]; Carol Coupland, PhD[5]; Michael Watson, PhD[6]; Mike Hayes, PhD[7]; Toity Deave, PhD[8]

[1] Professor of Primary Care Research, School of Medicine, Division of Primary Care, Tower Building, University Park, Nottingham NG7 2RD, UK

[2]Academic Clinical Fellow, School of Medicine, Division of Primary Care, Tower Building, University Park, Nottingham NG7 2RD, UK

[3] Consultant Community Paediatrician, Norfolk and Norwich University Hospital, Norwich Norfolk and Norwich University Hospitals NHS Foundation Trust, Colney Lane, Norwich NR4 7TJ, UK

[4] Institute of Health & Society, Baddiley-Clark Building, Newcastle University, Richardson Road, Newcastle upon Tyne, NE2 4AX, UK

[5]Associate Professor and Reader in Medical Statistics, School of Medicine, Division of Primary Care, Tower Building, University Park, Nottingham NG7 2RD, UK

[6] Associate Professor in Public Health, School of Health Sciences, University of Nottingham, D86, Queen's Medical Centre, Nottingham, NG7 2HA, UK

[7] Principal Consultant, Child Accident Prevention Trust, Canterbury Court (1.09), 1-3 Brixton Road, London, SW9 6DE, UK

[8] Associate Professor for Family and Child Health, Centre for Child & Adolescent Health, Health and Life Sciences, University of the West of England, Bristol, Oakfield House, Oakfield Grove, Bristol BS8 2BN, UK

Correspondence to:

Professor Denise Kendrick, Division of Primary Care, Tower Building, University Park, Nottingham NG7 2RD UK. E mail: denise.kendrick@nottingham.ac.uk Tel: 0115 8466914 Fax: 0115 8466904

Abstract word count: 255

Paper word count, excluding tables and references: 3173

All authors declare no financial relationships with any organisations that might have an interest in the submitted work in the previous three years and no other relationships or activities that could appear to have influenced the submitted work.

Abstract

Importance: Falls from furniture are common in young children presenting to emergency departments, but there is little evidence on protective factors for these falls.

Objective: To estimate associations for risk and protective factors for falls from furniture in children aged 0-4 years.

Design: Multicentre case-control study.

Setting: Hospitals, minor injury units and general practices in, and around four UK study centres.

Participants: 672 children with a secondary care attended fall from furniture and 2648 matched controls.

Exposures: Safety practices, safety equipment use and home hazards

Main outcome measure: Fall from furniture.

Results: Compared to controls, parents of cases were significantly more likely not to use safety gates in the home (adjusted odds ratio (AOR) 1.65, 95%CI 1.29, 2.12) and not to have taught their children rules about climbing on kitchen objects (AOR 1.58, 95% CI 1.16, 2.15). Cases aged 0-12 months were significantly more likely to have been left on raised surfaces (AOR 5.62, 95% CI 3.62, 8.72), had nappies changed on raised surfaces (AOR 1.89, 95%CI 1.24, 2.88) and been put in car or bouncing seats on raised surfaces (AOR 2.05, 95%CI 1.29, 3.27). Cases aged 3 years and over were significantly more likely to have played or climbed on furniture (AOR 9.25, 95%CI 1.22, 70.07). Cases were significantly less likely to have played or climbed on garden furniture (AOR 0.74, 95% CI 0.56, 0.97).

Conclusions: If estimated associations are causal, some falls from furniture may be prevented by incorporating falls prevention advice into child health contacts, personal child health records and home safety assessments.

Introduction

More than 1 million US and more than 200,000 UK children aged 0-4 years attend emergency departments (EDs) following a fall each year[1 2]. Falls account for approximately half the injury related ED attendances in this age group,[3] with falls from furniture being the most common mechanism. [4] Most of these falls involve beds, chairs ,[4 5] baby walkers, bouncers, changing tables and high chairs.[6 7] US costs for falls were estimated at $439 million for hospitalised children[8] and $643 million for ED[9] attendances in 2005. A recent systematic overview found that interventions can increase safety gate use and reduce baby walker use, but little evidence about other falls prevention practices or that prevention practices reduced falls or fall-related injuries. [10] We have therefore undertaken this study to quantify associations between modifiable risk factors and falls from furniture in young children.

Methods

Full details of the methods are described in the published protocol.[11]

Study design and setting

We undertook a multicentre case-control study in EDs, in-patient wards and minor injury units (services treating a limited range of non-serious injuries which are not set in acute hospitals.) in NHS hospitals in Nottingham, Bristol, Newcastle-upon-Tyne, Norwich, Gateshead, Derby and Great Yarmouth, UK. This was one of five concurrent case-control studies each recruiting children with one type of injury (falls from furniture, falls on one level, stair falls, poisoning or scalds) from these hospitals. Recruitment of cases commenced on June 14, 2010 and ended on November 15, 2011. Recruitment of controls commenced with recruitment of the first case and ended on April 27, 2012.

Participants

Cases were children aged 0-4 years with a fall from furniture attending an ED or minor injury unit or admitted to hospital. Children with intentional or fatal injuries or living in children's homes were excluded. Cases were only eligible to be recruited once to the study. Controls were children aged 0-4 years without a medically attended fall from furniture on the date of the case's injury. We aimed to recruit an average of four per case, individually matched on age (within 4 months of age of case), sex and calendar time (within four months of case injury). Controls were recruited from the case's general practice or a neighbouring practice, all of which were within the same study centre as the cases. Controls were eligible to be recruited a second time to the study as a case or further control after at least 12 months from first recruitment.

To increase power and make most efficient use of controls, where fewer than four controls were recruited per case, we used controls from cases with more than four controls, controls who were no longer matched to cases (e.g. the case had subsequently been excluded) and controls from the other on-going case-control studies (falls on one level, stair falls, poisoning or scalds) as extra controls. These were matched on age (within 4 months of case of age), sex, calendar time (within 4 months of case's injury) and study centre and were only used once as an extra matched control.

Potentially eligible cases were invited to participate during their medical attendance or by telephone or post within 72 hours of attendance. Ten controls were invited to participate by post, from the practice register for each case. General practice or Primary Care Trust staff searched practice registers for children of the same sex as the case and within 4 months of the cases date of birth. Where more than 10 met inclusion criteria, the 10 with the date of birth closet to that of the case were chosen. Postal study invites for cases and controls included a £5 voucher, a second questionnaire reminder, University logos on study information, personalised invite letters and first class mailing.[12 13]

Definition and measurement of outcomes, exposures and confounding variables

The outcome of interest was a fall from furniture in the child's home or garden (including yard) resulting in hospital admission, ED or minor injury unit attendance. Falls from play equipment (e.g. trampolines, climbing frames, slides) were excluded.

The exposures of interest were safety behaviours, safety equipment and home hazards. These included binary exposures measured in the 24 hours prior to the fall for cases or prior to questionnaire completion for controls, with yes/no response options:

a. use of stair/safety gates anywhere in the home,*
b. use of baby walkers (ages 0-36 months only)*
c. use of playpens/ travel cots (ages 0-36 months only)*
d. use of stationary activity centres (ages 0-36 months only)* and
e. presence of things child could climb on to reach high surfaces*.

Ordinal exposures measured in the week prior to the fall for cases or prior to completing questionnaires for controls, had response options every/ most/some days/never/not applicable. Responses were grouped into at least some days vs. never. Analyses excluded not applicable responses:

f. leaving children on raised surfaces,
g. changing nappies on raised surfaces,
h. putting children in car/bouncing seats on raised surfaces,
i. using high chairs without harnesses,
j. children climbing or playing on furniture
k. children climbing or playing on garden furniture

Two binary exposures measured whether parents had ever taught children safety rules with yes/no response options:

l. rules about not climbing on objects*
m. rules about not jumping on furniture*

Three confounding variables were dealt with by matching and conditional logistic regression: 1) age (within 4 months), 2) child sex, 3) calendar time (within 4 months of case injury date). Despite matching, some control general practices came from very different neighbourhoods than case practices and extra controls were not matched on practice, so all odds ratios were adjusted for neighbourhood deprivation using the Index of Multiple Deprivation (IMD)[14] (linear term) and distance between residence and hospital[15] (quintiles of km: ≤2, 2.1-3.2, 3.3-4.6, 4.7-8.2, >8.2). The IMD is a small (400-1200 households) area-based measure of multiple deprivation, containing seven domains (income deprivation, employment deprivation, health deprivation and disability, education skills and training deprivation, barriers to housing and services, living environment deprivation and crime).

Directed acyclic graphs (DAGs) were used to identify the minimal adjustment set for each multivariable model.[16-18] DAGs included age, sex, IMD and distance from hospital as adjusted variables and potential confounding variables (table 1) which were number of children in family, ethnic group (white/other), single adult household (yes/no), plus those identified as confounders and used for adjustment of some associations. These were 1) child behaviour questionnaire score (activity and high intensity pleasure sub scales)[19-21] (linear term), 2) hospital anxiety and depression scale[22] (linear term), 3) parenting daily hassles scale (parenting tasks subscale)[23 24] (linear term), 4) hours of out of home child care per week (linear term), 5) ability to climb measured using eight questions, with 3-point Likert scale responses from "not likely" to "very likely" (grouped as all 8 responses not likely, at least one quite likely but none very likely, at least one very likely), 6) first child (yes/no) and the starred exposures listed above. Unemployment, receipt of benefits, non-owner occupation, overcrowding, child health and quality of life were not included in DAGs as the IMD contains unemployment, income, housing and health domains. Not having a car was not included in DAGs because analyses were adjusted for IMD and distance from hospital.

Data on exposures, potential confounding variables, socio-demographic, child health and quality of life (PedsQL)[25] (listed in table 1), injuries and treatment received was ascertained from age-specific parent completed questionnaires (0-12 months, 13-36 months, ≥37 months). Some exposures (table 2) were validated with home observations in a sample of 162 cases and controls as previously reported.[26]

Study size

To detect an odds ratio of 1.43, with $\beta \leq 0.2$, $\alpha=0.5$, correlation between exposures in cases and controls of 0.1 and 4 controls per case required 496 cases and 1984 controls, based on exposure prevalences ranging from to 35% (child left on raised surface) to 76% (no stationary activity centre).[27 28]

Statistical methods

Odds ratios (ORs) and 95% confidence intervals (CIs) were estimated using conditional logistic regression, adjusted for neighbourhood deprivation, distance from hospital and confounders identified from DAGs. We assessed linearity of relationships between continuous confounders and case/control status by adding higher order terms to regression models and categorised where there was evidence of non-linearity. We used interaction terms to study whether associations varied by age, gender, ethnicity, single parenthood, non-owner occupied housing and unemployment, with a likelihood ratio test p value of <0.01 taken as significant.

For the PedsQL, mean scale scores were computed by summing items and dividing by number of items answered. Means were not computed where ≥50% items were missing.[29] Four percent of observations had missing data on <50% of items. We imputed single missing item values for subscales of the HADS using the mean of the remaining 6 items. This applied to 3% of observations. Where more than one item was missing, subscale scores were not computed.[22] The IBQ, ECBQ and CBQ allowed missing values and were scored as the total score divided by the number of questions answered. Missing values represent those with missing data on all scale items.[30] We were unable to find missing data guidance for the Parenting Daily Hassles Scale so we used the approach used for the HADS. Fifteen percent of observations had a single missing item. The main analyses are complete case analyses, including the single imputed values for the PedsQL, HADS and Parenting Daily Hassles Scale. The percentage of observations excluded from multivariable analyses due to missing data ranged from 15% to 25%. We imputed missing data based on all exposure and potential confounding variables (including single imputed values for scales described above) and case/control status, to create 20 imputed datasets. These were combined using Rubin's rules.[31]

Ethics

Approval was granted by Nottinghamshire Research Ethics Committee 1 (09/ H0407/14). Consent to participate was assumed by return of study questionnaires.

Results

In total 672 cases and 2648 controls (582 of whom were extra matched controls) participated (figure 1). 35% of cases and 33% of controls agreed to participate. Age group and sex were similar among case participants and non-participants (0-12 months: 34% vs. 31%; 13-36 months: 44% vs. 49%; ≥37 months 23% vs. 21% respectively; 54% male in both groups).. The mean number of controls per case was 3.94. Median days from date of injury to questionnaire completion was 10 (IQR 6, 20). Most cases sustained single injuries (86%); most commonly bangs on the head (59%), cuts/grazes not requiring stitches (19%) and fractures (14%). Most cases (60%) were seen and examined but did not require treatment, 29% were treated in ED and 4% were admitted to hospital.

[insert figure 1 here]

Cases were slightly younger than controls (1.74 vs. 1.91 years), had fewer hours of out-of-home child care per week (7.5 vs. 12), more of their parents were out of work (51% had at least 1 unemployed parent vs. 43%), receiving state benefits (43% vs. 36%), living in non-owner occupied housing (40% vs. 32%) and in neighbourhoods with higher deprivation scores (mean 16.8 vs. 14.9). Fewer parents of cases than controls thought their children were very likely to climb in at least one of eight scenarios (62% vs. 70%) (table 1).

[insert table 1 here]

The sensitivity, specificity and predictive values for exposures validated by home observations are shown in table 2. . Specificities were high (>70%) for all 7 items of safety or nursery equipment in cases and controls. Sensitivity was only high for 4 items in cases, and 2 in controls. NPVs were high for all 7 items in cases and for all except 1 item in controls. PPVs were only high for 3 items (all safety gate exposures) in cases and controls. The only items with high values for both sensitivity and specificity were safety gates at top and bottom of stairs.

[insert table 2 here]

Table 3 shows the frequency of exposures and odds ratios for the complete case and multiple imputation analyses, adjusted for the confounders listed in table 3 Parents of cases were significantly more likely not to use safety gates (adjusted odds ratio (AOR) 1.65, 95%CI 1.29, 2.12) and not to have taught children rules about climbing on objects in the kitchen (AOR 1.58, 95% CI 1.16, 2.15) than parents of controls. Cases were significantly more likely to have been left on raised surfaces (AOR 1.66, 95% CI 1.34, 2.06), and cases were significantly less likely to have climbed or played on garden furniture (AOR 0.74, 95% CI 0.56, 0.97) than controls. Odds ratios from the complete case and multiple imputation analyses did not differ by more than 10%.

[insert table 3 here]

The only significant interactions were between child age and four exposures. (table 4). Cases aged 0-12 were significantly more likely to have been left on raised surfaces (AOR 5.62, 95% CI 3.62, 8.72), had nappies changed on raised surfaces (AOR 1.89, 95% CI 1.24, 2.88) and been put in car/bouncing seats on raised surfaces (AOR 2.05, 95% CI 1.29, 3.27) than controls. Cases aged 13-36 months were significantly less likely to have been put in car/bouncing seats on raised surfaces (AOR 0.22, 95% CI 0.05, 0.94) than controls. Cases aged 3 years and older were significantly more likely to have climbed or played on furniture (AOR 9.25, 95% CI 1.22, 70.07) than controls. Five of the odds ratios from complete case and multiple imputation analyses differed by more than 10%.

[insert table 4 here]

Discussion

Main findings

A range of modifiable factors were associated with secondary care attended falls from furniture in children aged 0-4 years. Not using safety gates anywhere in the home, leaving children on raised surfaces, changing nappies on raised surfaces, putting car/bouncing seats on raised surfaces, children climbing or playing on furniture and not teaching children rules about things they should not climb on in the kitchen were all associated with increased odds of a fall.

Strengths and limitations

This is the largest published case-control study to date exploring modifiable factors for falls from furniture. The study was conducted in NHS hospitals across England, including urban and rural areas. Adjustment was made for a wide range of potential confounding factors using directed acyclic graphs. None of the AORs differed by more than 10% between analyses using complete cases and those using multiple imputation for the main analyses, but there were differences of more than 10% in AORs for five interaction analyses.

We validated measures for exposures where possible and found high (>70%) specificities and NPVs for six items of safety or nursery equipment, but high (>70%) sensitivities and PPVs for only three items. There is therefore likely to be some misclassification of exposures. This may result in odds ratios tending towards unity, but this does not always occur.[32] We did not collect data on whether and when safety gates were left open. We cannot therefore assume our OR would be the same for gates that had been closed throughout the 24 hours prior to the case injury.

The participation rates for cases (35%) and controls (33%) were similar, but low. If reasons for participation are associated with the exposure or outcome of interest, selection bias may have occurred. Our participation rates do not show large differences by case/control status, age and sex, but we were not able to assess prevalence of exposures in participants and non-participants. Most injuries in our study were minor and if parents seeking medical attention for minor injuries were also more likely to have exposures of interest, our ORs would be overestimated. As our exposures were self-reported, recall and social desirability bias may have occurred, potentially impacting on our ORs in different directions.

Residual confounding is a potential explanation for some of our findings. Families with gardens and garden furniture may be more advantaged than those without, and their children may therefore be at lower risk of falls.Children aged 13-36 months placed in car/bouncing seats on raised surfacesmay be less likely to be crawling or walking, and therefore at lower risk of falls than same aged children who do not use car/bouncing seats. This finding should also be interpreted with caution; it is based on a small amount of data (95%CI width 0.05-0.94) and ORs varied in the complete case and multiple imputation analyses (OR 0.22 vs. 0.59). The many exposures in our study resulted in multiple significance testing, hence some associations may have been significant by chance alone. Our estimates of associations for some items of nursery equipment were imprecise due to a lower prevalence of exposures than expected. Finally, bunk bed falls account for only 10% of falls from beds and with an annual incidence rate of 0.3/1000 children years,[6 33-36] so we did not include these as exposures in our study..

Comparisons with existing literature

We found only one Australian case-control study of infants with head or face trauma [37] with which to compare our findings. Findings were consistent with ours for changing nappies on high surfaces (OR 1.77, 95%CI 1.07, 2.92) and use of high chairs without harnesses (OR 1.47, 95%CI 0.73, 2.98). We found a slightly raised odds of a fall in children who had not used walker (OR 1.22, 95%CI 0.90, 1.65), consistent with the Australian study (OR for ever using baby walker 0.83, 95%CI 0.50–1.38). However, this was inconsistent with an increased odds of a head injury in those using a walker most days (OR 2.47, 95%CI 0.97, 6.48) found by the same study.

Implications for policy, practice and research

If our estimated associations are causal, some falls from furniture may be prevented by incorporating falls prevention advice into child health surveillance programmes, personal child health records, home safety assessments and other child health contacts. Larger studies are required to assess associations between use of bunk beds, baby walkers, playpens and stationary activity centres and falls.

Acknowledgements

We wish to thank the parents who participated in the study. We would also like to thank the Principal Investigators, liaison health visitors, research nurses and other staff from the emergency departments and minor injury units who assisted with recruiting participants from Nottingham University Hospitals NHS Trust, Derby Hospitals NHS Foundation Trust, Norfolk and Norwich University Hospitals NHS Foundation Trust, James Paget University Hospitals NHS Foundation Trust, University Hospitals Bristol NHS Foundation Trust, North Bristol Healthcare Trust, Newcastle Upon Tyne Hospitals NHS Foundation Trust, Gateshead NHS Foundation Trust and Northumbria Healthcare NHS Foundation Trust. We gratefully acknowledge the support provided for recruitment by the Primary Care Research Networks for East Midlands and South Yorkshire, Leicestershire, Northamptonshire and Rutland, East of England, Northern and Yorkshire and from South West and Trent, Norfolk & Suffolk, Northumberland Tyne and Wear and Western Comprehensive Local Research Networks. Written permission has been obtained and we thank Joanne Ablewhite, Penny Benford, Clare Timblin, Philip Miller, Jane Stewart, Persephone Wynn and Ben Young from the University of Nottingham; Gosia Majsak-Newman, Lisa McDaid, Clare Ferns and Nathalie Horncastle from the Norfolk and Norwich University Hospitals NHS Foundation Trust; Trudy Goodenough, Pilar Munoz and Benita Laird-Hopkins from the University of the West of England, Adrian Hawkins, Emma Davison and Laura Simms from the Great North Children's Hospital, Newcastle upon Tyne and Bryony Kay from the Bristol Royal Hospital for Children who helped with recruitment, data collection, prepared data for analysis or commented on drafts of papers. We would like to acknowledge the following Principal Investigators who contributed to obtaining funding, study design, project management in their centres and to interpretation of analyses and commented on drafts of papers: Elizabeth Towner (University of the West of England), Elaine McColl, (Newcastle University), Alex J Sutton and Nicola Cooper(University of Leicester) and Frank Coffey (Nottingham University Hospitals NHS Trust). We are also very grateful to Rose Clacy, lay research adviser, who

attended project management meetings, helped draft and pilot study documentation, advised on recruitment strategies and commented on drafts of the paper.

Authors' specific contributions:

Study concept and design: DK, RR, CC, MW, MH, TD

Acquisition of data: AM, PH, TD

Analysis and interpretation of data: DK, AM, CC, PH

Drafting of the manuscript: DK, AM

Critical revision of the manuscript for important intellectual content: All authors

Statistical analysis: DK, AM, CC

Study supervision: DK, RR, TD

DK had full access to all the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis.

Funding acknowledgement

This paper presents independent research funded by the National Institute for Health Research (NIHR) under its Programme Grants for Applied Research Programme (RP-PG-0407-10231). The views expressed in this article are those of the authors and not necessarily those of the NHS, the NIHR or the Department of Health.

Role of Sponsor: The study sponsor and funder played no role in study design or conduct of the study; the collection, management, analysis, and interpretation of data; preparation, review or approval of the manuscript; and the decision to submit the article for publication.

Conflict of Interest Disclosures: None reported. Funding was received for the study as described in the funding acknowledgement section. The authors declare no financial relationships with any organisations that might have an interest in the submitted work in the previous three years; no other relationships or activities that could appear to have influenced the submitted work.

Contributors: DK had the original idea for the study, designed the study, supervised data collection, contributed to writing the data analysis plan, undertook analyses, drafted sections of the paper and is the guarantor for this paper. AM contributed to writing the analysis plan, undertook analyses, contributed to the interpretation of the data and drafted sections of the paper. RR contributed to the design of the study, to supervising data collection, to interpretation of the data and to drafting the paper. PH collected data, contributed to interpretation of the data and to drafting the paper. CC contributed to the design of the study, writing the analysis plan, advised on analyses and on interpretation of data and contributed to drafting the paper. MW contributed to the study design, to interpretation of the data and drafted sections of the paper. MH contributed to the study design, to interpretation of the data and to drafting the paper. TD contributed to the study design, collected data, contributed to interpretation of the data and to drafting the paper. All authors agreed the final version of the paper and certify that the manuscript represents valid work and that neither this manuscript nor one with substantially similar content under their authorship has been published or is being considered for publication elsewhere. All researchers were independent of the funders.

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Figure 1: Selection of cases and controls and flow of participants through study

Table 1. Characteristics of cases and controls (percentage, unless stated otherwise) [missing values].

Characteristics	Cases n=672	Controls n=2648
Study centre		
Nottingham	246 (36.6)	966 (36.5)
Bristol	215 (32.0)	832 (31.4)
Norwich	146 (21.7)	644 (24.3)
Newcastle	65 (9.7)	206 (7.8)
Age group:*		
0-12 months	223 (33.2)	741 (28.0)
13-36 months	296 (44.1)	1270 (48.0)
37-62 months	153 (22.8)	637 (24.1)
Male	365 (54.3)	1478 (55.8)
Ethnic group: white	583 (88.9) [16]	2403 (92.2) [41]
Children aged 0-4 years in family	[6]	[40]
0	9 (1.4)	20 (0.8)
1	391 (58.7)	1563 (59.9)
2	231 (34.7)	927 (35.5)
≥3	35 (5.3)	98 (3.8)
First child	285 (45.4) [44]	1093 (44.9) [212]
Maternal age ≤19 at birth of first child**	77 (12.5) [4]	219 (9.0) [19]
Single adult household	95 (14.5) [15]	263 (10.2) [61]
Hours out-of-home child care (Median, IQR)	7.5 (0, 18.0) [46]	12.0 (1.0, 22.0) [179]
Adults out of work	[16]	[45]
0	319 (48.6)	1481 (56.9)
1	221 (33.7)	795 (30.5)
≥ 2	116 (17.7)	327 (12.6)
Receives state benefits	280 (43.0) [21]	928 (35.9) [65]
Overcrowding (>1 person per room)	56 (8.8) [32]	173 (6.9) [146]

Non-owner occupier	262 (39.5) [9]	838 (32.2) [49]
Household has no car	95 (14.4) [10]	288 (11.0) [40]
Index of multiple deprivation score (IMD) score (Median, IQR)	16.8 (10.0, 31.9)	14.9 (9.0, 26.8) [28]
Distance (km) from hospital (Median, IQR)	3.4 (1.9, 5.4)	3.9 (2.4, 7.4) [29]
Child behaviour questionnaire (CBQ) score (Mean, SD)	4.68 (0.92) [45]	4.67 (0.88) [234]
Long term health condition	60 (9.0) [5]	185 (7.0) [14]
Child health visual analogue scale (range 0-10) (median (IQR))	9.9 (9.3, 10.0) [6]	9.7 (8.5, 10.0) [22]
Health related quality of life in children aged 2 years and over (PedsQL)(Median, IQR)***	n=287 [4] 93.1 (86.9,97.6)	n=1270 [21] 90.0 (82.9, 94.4)
Parental assessment of child's ability to climb	[18]	[57]
All scenarios 'not likely'	166 (25.4)	536 (20.7)
≥ 1 scenario 'quite likely' and none 'very likely'	85 (13.0)	235 (9.1)
≥ 1 scenario 'very likely'	403 (61.6)	1820 (70.2)
Parenting daily hassles (PDH) tasks subscale (Median, IQR)****	13 (10, 17) [65]	14 (11, 18) [168]
Hospital anxiety and depression scale (HADS) (Mean, SD)****	10.7 (6.0) [8]	10.8 (6.0) [39]

Percentages may add up to more than 100 due to rounding. * age when questionnaire completed. **only applicable where mothers completed questionnaire. IMD: higher score indicates greater deprivation. CBQ: higher score indicates more active and more intense behaviour. PDH: higher score indicates more hassle. HADS: higher score indicates greater symptoms of anxiety/depression. Child health visual analogue scale: higher score indicates better health. PedsQL: higher score indicates better quality of life.
*** missing values refer to those with ≥ 50% items on any scale missing. **** missing values refer to those with more than one item missing

Table 2. Sensitivity, specificity and predictive values for self-reported exposures compared to observed exposures for cases and controls (95% confidence intervals) [missing values]

Reported exposure		Yes		No		Sensitivity	Specificity	PPV	NPV	Kappa value	X^2 (p)
Observed exposure		Yes	No	Yes	No						
Safety gate at top of stairs[1]	cases [1]	34	9	5	28	87.2 (72.6, 95.7)	75.7 (58.8, 88.2)	79.1 (64.0, 90.0)	84.8 (68.1, 94.9)	0.63 (0.46, 0.80)	0.14 (0.71)
	controls [2]	41	8	3	20	93.2 (81.3, 98.6)	71.4 (51.3, 86.8)	83.7 (70.3, 92.7)	87.0 (66.4, 97.2)	0.67 (0.49, 0.85)	
Safety gate at bottom of stairs[1]	cases [1]	25	7	3	41	89.3 (71.8, 97.7)	85.4 (72.2, 93.9	78.1 (60.0, 90.7)	93.2 (81.3, 98.6)	0.73 (0.57, 0.88)	0.00 (0.95)
	controls [5]	29	8	2	30	93.5 (78.6, 99.2)	78.9 (62.7, 90.4)	78.4 (61.8, 90.2)	93.8 (79.2, 99.2)	0.71 (0.55, 0.88)	
Other safety gates in the house[1]	cases [0]	9	1	11	56	45.0 (23.1, 68.5)	98.2 (90.6, 100)	90.0 (55.5, 99.7)	83.6 (72.5, 91.5)	0.52 (0.29, 0.74)	1.49 (0.22)
	controls [0]	15	3	22	34	40.5 (24.8, 57.9)	91.9 (78.1, 98.3)	83.3 (58.6, 96.4)	60.7 (46.8, 73.5)	0.32 (0.14, 0.51)	
Has baby walker[2]	cases [1]	2	14	2	40	50.0 (6.8, 93.2)	74.1 (60.3, 85.0)	12.5 (1.6, 38.3)	95.2 (83.8, 99.4)	0.10 (-0.12, 0.33)	0.24 (0.62)
	controls [0]	6	13	4	47	60.0 (26.2, 87.8)	78.3 (65.8, 87.9)	31.6 (12.6, 56.6)	92.2 (81.1, 97.8)	0.28 (0.03, 0.53)	
Has static play centre[2]	cases [2]	5	6	1	45	83.3 (35.9, 99.6)	88.2 (76.1, 95.6)	45.5 (16.7, 76.6)	97.8 (88.5, 99.9)	0.52 (0.22, 0.82)	3.36 (0.07)
	controls [0]	4	14	5	47	44.4 (13.7, 78.8)	77.0 (64.5, 86.8)	22.2 (6.4, 47.6)	90.4 (79.0, 96.8)	0.15 (-0.09, 0.40)	

Has playpen[2]	cases [1]	2	2	0	54	100 (15.8, 100)	96.4 (87.7, 99.6)	50.0 (6.8, 93.2)	100 (93.4, 100)	0.65 (0.21, 1.00)	0.53 (0.47)
	controls [1]	2	3	1	63	66.7 (9.4, 99.2)	95.5 (87.3, 99.1)	40.0 (5.3, 85.3)	98.4 (91.6, 100)	0.47 (0.03, 0.91)	
Has travel cot instead of a playpen[2]	cases [1]	4	4	3	47	57.1 (18.4, 90.1)	92.2 (81.1, 97.8)	50.0 (15.7, 84.3)	94.0 (83.5, 98.7)	0.46 (0.13, 0.80)	0.17 (0.68)
	controls [0]	1	4	2	63	33.3 (0.8, 90.6)	94.0 (85.4, 98.3)	20.0 (0.5, 71.6)	96.9 (89.3, 99.6)	0.21 (-0.20, 0.62)	

X^2 test for homogeneity. PPV = positive predictive value, NPV= negative predictive value.
Sensitivity = exposure reported and observed /total observed to have exposure. Specificity = exposure not reported and not observed /total not observed to have exposure
PPV = exposure reported and observed /total who reported exposure. NPV = exposure not reported and not observed /total not reporting exposure.
[1] Only includes those with stairs (cases: n=77; controls: n=74). [2] Questions only asked for children aged 0-36 months (cases: n=59; controls: n=70)

Table 3. Frequency of exposures in cases and controls and adjusted odds ratios from complete case and multiple imputation analyses [missing values] {not applicable responses}

Exposures	Cases n=672 (%)	Controls n=2648 (%)	Adjusted OR (95% CI) Complete case analysis†	Adjusted OR (95% CI) Multiple imputation analysis	Confounders adjusted for∫
Used safety gates*	389 (63.2)	1800 (72.4)	1.00	1.00	PDH, HADS, hours out-of-home care, ability to climb, first child
Did not use any safety gates	227 (36.9)	688 (27.6)	1.65 (1.29, 2.12)	1.62 (1.25, 2.10)	
	[56]	[160]			
Did not use high chair without harness**	330 (73.7)	1239 (70.4)	1.00	1.00	CBQ, hours out-of-home care
Used high chair without harness	118 (26.3)	522 (29.6)	0.77 (0.57, 1.03)	0.81 (0.63, 1.04)	
	[11] {213}	[34] {853}			
Did not have things child could climb on to reach high surfaces*	412 (62.4)	1551 (59.1)	1.00	1.00	Hours out-of-home care, ability to climb, first child, safety gate, safety rules about climbing in kitchen and jumping on furniture
Had things child could climb on to reach high surfaces	248 (37.6)	1075 (40.9)	0.96 (0.75, 1.24)	0.88 (0.68, 1.13)	
	[12]	[22]			
Had not left child on a raised surface**	262 (42.3)	1273 (51.0)	1.00	1.00	CBQ, hours out-of-home care
Left child on a raised surface	357 (57.7)	1221 (49.0)	1.66 (1.34, 2.06)†	1.68 (1.37, 2.05)	
	[13] {40}	[33] {121}			
Had not changed nappy on raised surface**	233 (44.0)	947 (46.1)	1.00	1.00	CBQ, hours out-of-home care
	297 (56.0)	1106 (53.9)	1.10 (0.87, 1.40) †	1.13 (0.93, 1.38)	

Changed nappy on raised surface	[10] {132}	[30] {565}			
Had not put child in car or bouncing seat on raised surface **	460 (88.6)	1816 (91.2)	1.00	1.00	CBQ, hours out-of-home care
Put child in car or bouncing seat on raised surface	59 (11.4) [11] {142}	176 (8.8) [30] {626}	1.35 (0.91, 2.01) †	1.24 (0.87, 1.77)	
Child had not climbed or played on furniture**	132 (21.9)	543 (22.2)	1.00	1.00	CBQ, hours out-of-home care, things child could climb on to reach high surfaces
Child climbed or played on furniture	472 (78.2) [7] {61}	1909 (77.9) [27] {169}	1.03 (0.73, 1.44) †	1.04 (0.77, 1.42)	
Child had not climbed or played on garden furniture**	345 (65.6)	1272 (60.9)	1.00	1.00	CBQ, hours out-of-home care, things child could climb on to reach high surfaces
Child climbed or played on garden furniture	181 (34.4) [10] {136}	816 (39.1) [28] {532}	0.74 (0.56, 0.97)	0.75 (0.59, 0.95).	
Had taught child rules about climbing in kitchen	351 (55.5)	1540 (60.0)	1.00	1.00	HADS, PDH, first child, things child could climb on to reach high surfaces
Not taught child rules about climbing in kitchen	282 (44.5) [39]	1026 (40.0) [82]	1.58 (1.16, 2.15)	1.46 (1.11, 1.93)	
Had taught child rules about jumping on bed or furniture	353 (55.5)	1489 (58.0)	1.00	1.00	HADS, PDH, first child, things child could climb on to reach high surfaces
Not taught child rules about jumping on bed or furniture	283 (44.5) [36]	1079 (42.0) [80]	1.21 (0.87, 1.68)	1.22 (0.91, 1.63)	
Safety practices measured only in children aged 0-36 months	Cases n=519	Controls n=2011	Adjusted OR (95% CI)	Adjusted OR (95% CI)	

			Complete case analysis	Multiple imputation analysis	
Used baby walker* Did not use baby walker	134 (26.5) 372 (73.5) [13]	616 (31.2) 1359 (68.8) [36]	1.00 1.22 (0.90, 1.65)	1.00 1.36 (1.06, 1.74)	HADS, PDH, hours out-of-home care, ability to climb, first child, safety gate, playpen/travel cot, activity centre
Used playpen or travel cot* Did not use playpen or travel cot	91 (18.1) 411 (81.9) [17]	342 (17.4) 1628 (82.6) [41]	1.00 1.01 (0.71, 1.46)	1.00 0.94 (0.70, 1.23)	HADS, PDH, hours out-of-home care, ability to climb, first child, baby walker, safety gate, activity centre
Used stationary activity centre* Did not use stationary activity centre	128 (25.5) 375 (74.6) [16]	503 (25.5) 1469 (74.5) [39]	1.00 0.94 (0.69, 1.27)	1.00 0.92 (0.71, 1.19)	HADS, PDH, hours out-of-home care, ability to climb, first child, baby walker, playpen/travel cot, safety gate

Percentages may not add up to 100% due to rounding. * in the last 24 hours ** at least some days in the last week. †Complete case analysis includes single imputed values for PedsQL, Hospital anxiety and depression scale, Parenting daily hassles scale as described in methods All adjusted models adjusted for index of Multiple Deprivation and distance from hospital in addition to listed confounders. CBQ = Child behaviour questionnaire, PDH = Parenting daily hassles scale. HADS= Hospital anxiety and depression scale.

Table 4. Comparison between complete case analysis and analysis using multiple imputation where significant interactions were found in the complete case analysis

Exposures	0-12 months		13-36 months		≥37 months		Test for interaction
	Complete case analysis† Adjusted OR (95% CI)	Multiple imputation analysis Adjusted OR (95% CI)	Complete case analysis† Adjusted OR (95% CI)	Multiple imputation analysis Adjusted OR (95% CI)	Complete case analysis† Adjusted OR (95% CI)	Multiple imputation analysis Adjusted OR (95% CI)	
Had not left child on raised surface*	1.00	1.00	1.00	1.00	1.00	1.00	$P_{CC}<0.001$ $P_{MI}<0.001$
Left child on raised surface	5.62 (3.62, 8.72)	4.46 (3.08, 6.48)	1.05 (0.77, 1.44)	1.17 (0.88, 1.57)	1.00 (0.64, 1.57)	0.99 (0.67, 1.48)	
Had not changed nappy on raised surface*	1.00	1.00	1.00	1.00	1.00	1.0	$P_{CC}=0.004$ $P_{MI}=0.02$
Nappy changed on raised surface	1.89 (1.24, 2.88)	1.82 (1.27, 2.62)	0.81 (0.59, 1.11)	0.92 (0.69, 1.22)	0.76 (0.31, 1.92)	0.95 (0.58, 1.53)	
Had not put child in car/bouncing seat on raised surface*	1.00	1.00	1.00	1.00	1.00	1.00	$P_{CC}=0.001$ $P_{MI}= 0.03$

Put child in car/bouncing seat on raised surface	2.05 (1.29, 3.27)	2.02 (1.33, 3.06)	0.22 (0.05, 0.94)	0.59 (0.24, 1.45)	0.72 (0.13, 3.87)	0.69 (0.22, 2.13)	
Child had not climbed or played on furniture*	1.00	1.00	1.00	1.00	1.00	1.00	P_{CC}=0.007 P_{MI}= 0.03
Child climbed or played on furniture	0.96 (0.60, 1.52)	0.99 (0.66, 1.50)	0.75 (0.41, 1.34)	0.75 (0.46, 1.21)	9.25 (1.22, 70.07)	5.59 (1.31, 23.89)	

Adjusted for confounders as in table 3. * at least some days in the last week. † Complete case analysis includes single imputed values for PedsQL, Hospital anxiety and depression scale, Parenting daily hassles scale as described in methods * in the last 24 hours ** at least some days in the last week. P_{CC}= P value from complete case analysis.
P_{MI}=P value from multiple imputation analysis